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ENERGY
COMMISSION

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Gray Davis, *Governor*

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Assembly Bill 970 Building Energy Efficiency Standards

2001 AB 970
Nonresidential Energy Conservation
Manual Supplement

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This 2001 AB 970 Nonresidential Energy Conservation Manual Supplement includes descriptions and clarifications of the 2001 AB 970 Energy Efficiency Standards for Nonresidential Buildings. This Manual is intended as a supplement to the July 1999 Nonresidential Manual (P400-98-005). This manual supplement was certified at the Energy Commission's January 3, 2001 Business Meeting. The manual supplement represents revisions to the Title 24 Building Energy Efficiency Standards (California Code of Regulations, Title 24, Part 6 and the Administrative Regulations, Title 24, Part 1.)

January 4, 2001

NONRESIDENTIAL

Introduction

On September 6, 2000, Governor Gray Davis signed into law Assembly Bill (AB) 970, the California Energy Security and Reliability Act, to avoid electricity supply failures and extremely high electricity bills. AB 970 required the California Energy Commission (Commission) to adopt new emergency energy efficiency standards for residential and nonresidential buildings within 120 days. The AB 970 mandate for these emergency standards is to ensure maximum feasible reductions in wasteful, uneconomic, inefficient or unnecessary consumption of electricity.

The new 2001 AB 970 Energy Efficiency Standards for Residential and Nonresidential Buildings (Standards) require applicable buildings to be more energy efficient than the 1998 Standards.

This Manual describes the changes to the 1998 Nonresidential Standards, and provides information to help the design, construction and enforcement communities to comply with these important changes. The *NONRESIDENTIAL MANUAL* dated July 1999, publication number P400-98-005, is referenced for use except as herein otherwise noted. P400-98-005 may be obtained in CD-ROM format or may be downloaded in PDF format from the Commission website:

http://www.energy.ca.gov/title24

This supplement is intended to be used in conjunction with the *2001 AB 970 Building Energy Efficiency Standards*, and therefore, is organized in the order that the changes appear in the Standards. The reader should recognize that this document does not attempt to present the changes in the order of their energy importance.

The *2001 Building Energy Efficiency Standards* may be downloaded in PDF format from the Commission website:

http://energy.ca.gov/ab970_standards

Effective Date

The effective date of the AB 970 Building Energy Efficiency Standards amendments shall be June 1, 2001.

Summary of Changes to the 1998 Standards

- ***Section 10-111*** **-** Certification and Labeling of Fenestration Product U-Factors, Solar Heat Gain Coefficient, and Air Leakage to Include Site-built Fenestration NFRC Certification
- ***Section 10-113*** **(New Section) -** Certification and Labeling of Roofing Product Reflectance and Emittance
- ***Section 101*** **-** Various definitions have been added.
- ***Section 112*** **-** Mandatory Requirements for Space-Conditioning Equipment
- ***Section 113*** **-** Mandatory Requirements for Service Water-Heating Systems and Equipment
- ***Section 116*** - Mandatory Requirements for Fenestration Products and Exterior Doors
- ***Section 118*** **(New Text) -** Mandatory Requirements for Cool Roofs
- ***Section 121*** **-** Requirements for Ventilation
- ***Section 123*** **-** Requirements for Pipe Insulation
- ***Section 124*** **-** Requirements for Air Distribution System Ducts And Plenums
- ***Section 130*** **-** Lighting Systems and Equipment—General
- ***Section 131*** - Lighting Controls That Must Be Installed
- ***Section 143*** - Prescriptive Requirements for Building Envelopes
- ***Section 144*** **-** Prescriptive Requirements for Space-Conditioning Systems
- ***Section 146*** **-** Prescriptive Requirements for Lighting

Economic Summary

The Energy Commission is required by law to develop and maintain energy efficiency standards that are "cost effective, when taken in their entirety, and when amortized over the economic life of the structure when compared with historic practice."[1] The 2001 Energy Efficiency Standards were shown to be extremely cost effective.

Summary of Changes to Each Section

Section 10-111 - Certification and Labeling of Fenestration Product U-Factors, Solar Heat Gain Coefficient, and Air Leakage

Section 10-111 includes NFRC labeling requirements. This section is modified to add the NFRC labeling and testing requirements, in NFRC-100SB, including NFRC's "Label Certificate," as a method to meet the labeling requirements.

Section 10-113 **(New Section) -** Certification and Labeling of Roofing Product Reflectance and Emittance

This section establishes rules for implementing labeling and certification requirements effective January 1, 2003, relating to reflectance and emittance for roofing products for showing compliance with Section 141, 142, and 151(b) of Title 24, California Code of Regulations, Part 6. This section designates the Cool Roof Rating Council (CRRC) as the supervisory entity responsible for administering the state's cool roof labeling and certification program, provided CRRC meets specified criteria.

Section 101 – Definitions. Fourteen definitions are either added or modified.

Section 112 **-** Mandatory Requirements for Space-Conditioning Equipment

The changes in this section include revised efficiency requirements for heating and cooling equipment. These new efficiency requirements, adopted from ASHRAE 90.1-1999, are presented in Tables 1-C1 through 1-C7. New efficiency levels are required for equipment manufactured on or after October 29, 2001.

Section 113 **-** Mandatory Requirements for Service Water-Heating Systems and Equipment

Section 113 is modified to include the revised efficiency requirements for water heating in Table 1-C11, which are adopted from ASHRAE 90.1-1999. New efficiency levels are required for equipment manufactured on or after October 29, 2001.

Section 116 - Mandatory Requirements for Fenestration Products and Exterior Doors

Section 116 has procedures for determining the U-factor and SHGC for fenestration systems and products. This section is modified to require NFRC-100SB rating and labeling requirements for site assembled vertical glazing in buildings except those with less than 100,000 ft^2 of floor area or less than 10,000 ft^2 of glass. It is also modified to allow the use of ASHRAE default tables for skylights and site-built fenestration systems in buildings not required to use NFRC-100SB. Attachment A specifies calculations and eligibility criteria for determining U-factors and SHGCs for buildings not required to use NFRC-100SB.

The existing default tables (1-D and 1-E) continue to be available for use for fenestration products and systems other than skylights and site-built fenestration systems using NFRC-100SB. In showing compliance, the sources of information (i.e., labels, label certificates, manufacturer information or default table) for U-factor and SHGC values should be shown in the "Location/Comments" field of ENV-1.

Section 118 **(New Text) -** Mandatory Requirements for Insulation and Cool Roofs

Effective January 1, 2003, a roof shall be considered a cool roof only if it is rated and certified according to requirements of Section 10-113. Prior to January 1, 2003, manufacturers' published performance data shall be acceptable to show compliance with §118(f)1 or 2 and §118(f)3 for liquid applied roofing products.

[1] Warren Alquist Act, Section 25402.

Section 121 - Requirements for Ventilation

Demand ventilation controls are now required for HVAC systems serving areas identified in Chapter 10 of the UBC as Assembly Areas, Concentrated Use (without fixed seats) or Auction Rooms with design outdoor air capacities equal to or exceeding 3000 cfm.

Section 123 - Requirements for Pipe Insulation

Pipe insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. Insulation exposed to weather shall be protected as specified. Insulation covering chilled water piping and refrigerant suction piping, located outside conditioned space, shall be protected as specified.

Section 124 - Requirements for Air Distribution System Ducts and Plenums

Ducts and plenum insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. Insulation exposed to weather shall be protected as specified.

Section 130 - Lighting Systems and Equipment—General

Section 130(c) sets a minimum efficacy value of 60 lumens/watt for exterior lighting over 100 watts attached to or powered by the electrical service in buildings. Section 130(d) specifies how to determine luminaire wattage.

Section 131 - Lighting Controls That Must Be Installed

Section 131 removes exceptions to bi-level control and expands coverage of the automatic shut-off control requirement.

There no longer are exceptions to the bi-level control requirement for occupancy sensors or automatic time switches. Bi-level controls are required in all spaces over 100 square feet that have a lighting load greater than 0.8 W/ft$^{2.}$

There is no longer an exception from the automatic shut-off control requirement for buildings and separately metered spaces with less than 5000 ft^2 of conditioned floor area.

Section 143 - Prescriptive Requirements for Building Envelopes

Tables 1-H and 1-I include new requirements for windows and skylights. U-factor and SHGC values are set lower: for vertical glazing, the values depend on the window-to-wall ratio, and for skylights the values depend on the type of skylight construction. The "north" maximum relative solar heat gain for first floor display glazing or for glazing where codes restrict the use of overhangs is the larger of the appropriate value from Tables 1-H or 1-I or 0.56.

Climate zones have been regrouped to form groups with the same prescriptive envelope requirements.

In Section 143(b) the overall heat gain tradeoff equation has been changed to add a cool roof alternative.

Section 144 - Prescriptive Requirements for Space-Conditioning Systems

Acceptable high-limit shut-off control types for airside economizers are specified based on climate zone.

In addition, an equipment efficiency alternative to an economizer has been added for specified climate zones and size categories of electrically operated unitary air conditioners and heat pumps.

A new subsection sets requirements for heat rejection system controls used in equipment such as air-cooled condensers, open cooling towers, closed-circuit cooling towers, and evaporative condensers.

Section 146 - Prescriptive Requirements for Lighting

This section clarifies that portable lighting is required to be included when determining the actual lighting power. If no specific plans for portable (task) lighting are provided for spaces over 250 square feet, the standards specify a default value of 0.2 W/sf for the task lighting, to be used in determining the actual lighting power density. The actual lighting power for portable

lighting may be used if sufficient supporting evidence is provided on the plans.

Control credits are no longer available for lumen maintenance controls.

The exclusion from actual lighting power for exit sign lighting watts is changed to exclude only those exit signs that have an input power rating of five watts per illuminated face or less. Exit lighting with higher power levels must be included in calculations of actual lighting power.

Allowed lighting power is being adjusted to match ASHRAE/IESNA 90.1-1999 lighting levels for convention centers, hotel lobbies and locker/dressing rooms.

Performance Compliance

Two new performance compliance credits have been added with the new standards.

The Commission has approved procedures for determining duct and HVAC distribution efficiency for non-residential single-zone individual packaged equipment serving 5000 ft^2 or less via ductwork in the space between an insulated ceiling and the roof. This compliance credit requires third-party field verification. The compliance computer program vendor's Compliance Supplement will document eligibility criteria for using these procedures.

The Commission has approved procedures for determining the benefits of cool roofs. The compliance computer program vendor's Compliance Supplement will document eligibility criteria for using these procedures.

Attachment A– Default Fenestration Thermal Properties

Solar Heat Gain Coefficient

Determination of Solar Heat Gain Coefficients for Fenestration without Certified NFRC Values

This section describes the calculation method, eligibility criteria, and documentation requirements for determining the SHGC of fenestration for which there is no certified NFRC value.

Site-Assembled Fenestration Products and Field-fabricated Fenestration

This section describes the alternative calculation method for determining compliance for site-assembled and field-fabricated products similar to site-built products.

Site-assembled fenestration includes both field-fabricated fenestration and fenestration whose frame is previously cut or formed by a manufacturer with the specific intention of being used with a glazing assembly to create a complete fenestration product.

Field-fabricated fenestration is a fenestration product whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut or otherwise formed with the specific intention of being used to fabricate a fenestration product.

For site-assembled and field-fabricated fenestration, use the following equation to calculate the SHGC for fenestration that is used to determine compliance. Convert the center of glass SHGC, $SHGC_c$, from the manufacturer's documentation to a value for the fenestration product with framing, $SHGC_{fen,}$

$$\mathbf{SHGC_{fen} = 0.08 + 0.86 \times SHGC_c}$$

Where:
$SHGC_c$ is the SHGC for the center of glass alone, and

$SHGC_{fen}$ is the SHGC for the fenestration including glass and frame.

Manufactured Fenestration Products

This section describes the alternative calculation method for determining compliance for manufactured products that do not have SHGC values published by the National Fenestration Rating Council (NFRC) in the *NFRC Certified Products Directory*.

Manufactured Fenestration Products without an SHGC certified to the NFRC are similar to those that have an SHGC certified to NFRC. They are complete products, shipped from the manufacturer with the frame and glazing already assembled. These products may be listed in the directory with their U-factors but without an SHGC. As of January 1, 2001, the number of these products is very small and includes only those with non-planar or translucent glazing. To determine compliance with the building efficiency standards, the center of glass SHGC from the manufacturer's documentation must be converted to an SHGC that includes the framing effect. Use the following equation:

$$\mathbf{SHGC_{fen} = 0.11 + 0.81 \times SHGC_c}$$

Where:
$SHGC_c$ is the SHGC for the center of glass alone, and

$SHGC_{fen}$ is the SHGC for the fenestration including glass and frame.

Responsibilities for Compliance

This section describes the responsibilities of energy consultants, designers, architects, builders, installers, and building departments when this alternative calculation method is used for determining compliance with SHGC requirements.

Energy Consultants, Designers, Architects

Products with SHGCs Certified to NFRC

SHGCs can be found in the NFRC *Certified Products Directory,* SV section. Contact NFRC at 301-589-6372 for a copy of the directory or go to NFRC's website at www.nfrc.org for an online database of the directory.

Field-Fabricated Fenestration, Site-Assembled Fenestration and Fenestration Products without SHGC Certified to NFRC

The procedure described below does not apply to site-assembled vertical glazing in buildings with (a) 100,000 sf or more of conditioned floor area and (b) 10,000 sf or more of vertical fenestration area. For these glazing assemblies, use the NFRC 100SB Label Certificate procedure described above. (For projects where the building has 100,000 sf or more of conditioned space and 10,000 sf or more of fenestration area, the SHGC of the vertical glazing must be obtained using NFRC 100SB and must be verified by a Label Certificate for Site-Built Products. The Label Certificate must be included with the plans or be provided on site at the time of inspection.)

To determine compliance with the efficiency standards, the center of glass SHGC from the manufacturer's documentation for the proposed glazing must be converted to an $SHGC_{fen}$ for the fenestration that includes the framing effect. For the Prescriptive compliance method, the $SHGC_{fen}$ is then entered into the prescriptive ENV-1 form, Part 2 of 2 and must appear on the plans.

For the Performance compliance method, the $SHGC_{fen}$ output information printed on the Performance ENV-1 form must be listed on the building plans. The PERF-1 and Performance ENV-1 forms must appear on the plans. The building plan window schedule list must indicate the proposed total $SHGC_{fen}$ values for each fenestration assembly, and these values must be equal to the SHGCs listed on the Performance ENV-1 computer form. (Note: an under-calculation of space conditioning energy can result from entering either too low or too high an $SHGC_{fen}$ for the product.) The proposed design $SHGC_{fen}$ values are entered into the computer program to automatically generate the energy budget of the standard design and the energy use of the proposed design. The building complies if the total energy use of the proposed design is the same or less than the standard design energy budget.

Permit applications must include heat gain documentation for the Building Plan Checker. This documentation must include a copy of the manufacturer's documentation showing the $SHGC_c$, center of glass alone and the calculation used to determine the $SHGC_{fen}$. If the proposed design uses multiple fenestration products or site-assembled fenestration products, a calculation for each different $SHGC_{fen}$ must be attached to the plans along with each glass unit manufacturer's documentation.

Mixed Fenestration Types

If mixed fenestration is included in the compliance analysis, then the compliance submittal must demonstrate which are certified fenestration products and which are non-certified fenestration or site-assembled fenestration products. The manufacturer's documentation and calculations for each product must be included in the submittal, and either the ENV-1 or PERF-1 form must be included on the building plans.

Builder and Installer Responsibilities

The builder is responsible for assuring that the glass documentation showing the SHGC used for determining compliance is provided to the installer. The builder is responsible for obtaining an NFRC Label Certificate for Site-Built Products for the building's vertical glazing if the building is 100,000 sf or more and has 10,000 sf or more of vertical glazing.

The builder is also responsible for assuring that the persons preparing compliance documentation are specifying products that the builder intends to install. The builder must assure that the glazing contractor installs the glass with the same $SHGC_c$ as used for compliance and that the building inspector is provided with manufacturers' documentation showing the $SHGC_c$ for the actual glass product installed. The builder should verify that these fenestration products are clearly shown on the building plans before fenestration products are purchased and installed.

Building Department Responsibilities - Plan Checker

The building department plan checker is responsible for assuring that the plans identify which fenestration is site-assembled and which is not. The plan-checker is responsible for verifying that the $SHGC_{fen}$ and $SHGC_c$ for non-certified fenestration products or site-assembled products is identified on the plans, that calculations have been provided showing the conversion from $SHGC_c$ to $SHGC_{fen}$, and that manufacturer documentation of the $SHGC_c$ has been provided for the fenestration to be installed. Plans should be consistent with the compliance documentation, the calculations showing the conversion from $SHGC_c$ to $SHGC_{fen}$, and Prescriptive ENV-1 Part 2 of 2 or Performance ENV-1.

Building Inspector

The building department field inspector is responsible for assuring that manufacturer's documentation has been provided for the installed fenestration. The inspector is responsible for checking the NFRC label for manufactured fenestration products, or the NFRC 100SB Label Certificate for site-built products where appropriate as described below [see "Energy Consultants, Designers, Architects: Products with SHGCs Certified to NFRC" above].

(a.) All manufactured fenestration products must have either an NFRC label or manufacturer's label with default SHGCs from Table 1-E.
(b.) All site-assembled fenestration products in buildings 100,000 sf of conditioned floor area or more and 10,000 sf of vertical fenestration area or more must have either an NFRC Label Certificate for Site-Built Fenestration Products or a manufacturer's certificate with a default SHGC from Table 1-E.
(c.) Site-assembled vertical fenestration products in buildings less than 100,000 sf, or buildings with less than 10,000 sf of vertical glazing, may use either of the rating/labeling methods described in (b) above, or the $SHGC_{fen}$ calculation method described in this section.
(d.) Horizontal glazing that does not have a certified NFRC SHGC may use any of the above methods for determining and labeling or certifying the SHGC.

The field inspector is responsible for assuring that the certified SHGC, or $SHGC_c$ and $SHGC_{fen}$, for the installed fenestration is consistent with the plans, the Prescriptive ENV-1 Part 2 of 2 or the Performance PERF-1 and Performance ENV-1, and that manufacturer documentation is consistent with the product installed in the building. Plans shall indicate which fenestration is site-assembled or is a fenestration product without SHGCs certified to the NFRC.

Thermal Transmittance (U-Factor)

Table I-1 provides default U-factors for skylights and site-built fenestration in buildings covered by the Nonresidential Energy Standards. The default table may be used only for the following:

- Site-assembled and field-fabricated glazed wall systems in buildings covered by the Nonresidential Energy Standards that have less than 100,000 square feet of conditioned floor area or less than 10,000 square feet of vertical glazing.

- Skylights in buildings covered by the Nonresidential Energy Standards.

The default Table I-1 is consistent with default U-factors published in Table 5, Chapter 29, ASHRAE Fundamentals Handbook, 1997, which is referenced in the Energy Standards. Fenestration products fitting the two descriptions above may still use U-factors obtained through NFRC if available.

Responsibilities for Compliance

This section describes the responsibilities of energy consultants, designers, architects, builders, installers, and building departments when Table I-1 is used for determining compliance with the U-factor requirements of the Efficiency Standards.

Energy Consultants, Designers, Architects

Products with U-factor Certified to NFRC

U-factor values can be found in the *NFRC Certified Products Directory.* Contact NFRC at 301-589-6372 for a copy of the directory or go to NFRC's website at www.nfrc.org for an online database of the directory.

Field-Fabricated Fenestration, Site-Assembled Fenestration and Fenestration Products without U-factor Certified to NFRC

To determine compliance with the efficiency standards, the Glazing Type and Frame Type shown in Table I-1 must be identified from the manufacturer's documentation for the proposed glazing. For the Prescriptive compliance method, the U-factor must be selected from Table I-1 for this Glazing Type and Frame Type and entered into the prescriptive ENV-1 form, Part 2 of 2, and must appear on the plans.

For the Performance compliance method, the U-factor output information printed on the Performance ENV-1 form must be listed on the building plans. The PERF-1 and Performance ENV-1 forms must appear on the plans. The building plan window schedule list must indicate the proposed total U-factors for each fenestration assembly, and these values must be equal to or less than the U-factors listed on the Performance ENV-1 computer form. The proposed design U-factors are entered into the computer program to automatically generate the energy use of the proposed design. The building complies if the total energy use of the proposed design is the same or less than the standard design energy budget.

Permit applications must include fenestration U-factor documentation for the Building Plan Checker. This documentation must include a copy of the manufacturer's documentation showing the Glazing Type information – number of panes, spacing of panes, glass type, gas fill type, coating emissivity and location – and the Frame Type – frame material type, presence of thermal breaks, and identification of structural glazing (glazing with no frame) that is used to determine the U-factor. If the proposed design uses multiple fenestration products or site-assembled fenestration products, manufacturer's documentation for each different U-factor must be attached to the plans for each glass unit. Manufacturer's documentation must be provided for each U-factor used for compliance.

Mixed Fenestration Types

If mixed fenestration is included in the compliance analysis, then the compliance submittal must demonstrate which are certified fenestration products and which are non-certified fenestration or site-assembled fenestration products. The manufacturer's documentation and calculations for each product must be included in the submittal, and either the ENV-1 or PERF-1 form must be included on the building plans.

Builder and Installer Responsibilities

The builder is responsible for assuring that the glass documentation showing the U-factor used for determining compliance is provided to the installer. The builder is responsible for assuring that the persons preparing compliance documentation are specifying products that the builder intends to install. The builder is also responsible for assuring that the installer installs glass with the same U-factor as used for compliance and assuring that the field inspector for the building department is provided with manufacturer's documentation showing the U-factor and method of determining U-factor for the actual fenestration product installed. The builder should verify that these fenestration products are clearly shown on the building plans before fenestration products are purchased and installed.

Building Department Responsibilities

Plan Checker

The building department plan checker is responsible for assuring that the plans identify which fenestration is site-assembled and which is not. The plan-checker is responsible for verifying that the U-factor for non-certified fenestration products or site-assembled products is identified on the plans, that Glazing Type and Frame Type and Table 1-I have been provided showing the method of determining the U-factor, and that manufacturer documentation of the U-factor has been provided for the fenestration to be installed. Plans should be consistent with the compliance documentation, the Glazing Type and Frame Type and Table I-1

values, and Prescriptive ENV-1 Part 2 of 2 or Performance ENV-1.

Building Inspector

The building department field inspector is responsible for assuring that manufacturer's documentation has been provided for the installed fenestration. The field inspector is responsible for assuring that the U-factor for the installed fenestration is consistent with the plans, the Prescriptive ENV-1 Part 2 of 2 or the Performance PERF-1, and Performance ENV-1, and that manufacturer documentation is consistent with the product installed in the building.

Plans shall indicate which fenestration is site-assembled or is a fenestration product without U-factor certified to NFRC.

Table I-1 – Assembly U-Factors for Unlabeled Glazed Wall Systems (Site-Built Windows) and Unlabeled Skylights

Product Type		Vertical Installation				Sloped Installation						
		Unlabeled Glazed Wall Systems (Site Built Windows) (includes site assembled fixed windows only, does not include operable windows)				**Unlabeled Skylight with Curb** (includes glass/plastic, flat/domed, fixed/operable)				**Unlabeled Skylight without Curb** (includes glass/plastic, flat/domed, fixed/operable)		
Frame Type		Aluminum without Thermal Break	Aluminum with Thermal Break	Wood/Vinyl	Structural Glazing	Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum Clad Wood	Wood/Vinyl	Aluminum without Thermal Break	Aluminum with Thermal Break	Structural Glazing
ID	**Glazing Type**											
	Single Glazing											
1	1/8" glass	1.22	1.11	0.98	1.11	1.98	1.89	1.75	1.47	1.36	1.25	1.25
2	1/4" acrylic/polycarb	1.08	0.96	0.84	0.96	1.82	1.73	1.60	1.31	1.21	1.10	1.10
3	1/8" acrylic/polycarb	1.15	1.04	0.91	1.04	1.90	1.81	1.68	1.39	1.29	1.18	1.18
	Double Glazing											
4	1/4" airspace	0.79	0.68	0.56	0.63	1.31	1.11	1.05	0.84	0.82	0.70	0.66
5	1/2" airspace	0.73	0.62	0.50	0.57	1.30	1.10	1.04	0.84	0.81	0.69	0.65
6	1/4" argon space	0.75	0.64	0.52	0.60	1.27	1.07	1.00	0.80	0.77	0.66	0.62
7	1/2" argon space	0.70	0.59	0.48	0.55	1.27	1.07	1.00	0.80	0.77	0.66	0.62
	Double Glazing, *e*=0.60 on surface 2 or 3											
8	1/4" airspace	0.76	0.65	0.53	0.61	1.27	1.08	1.01	0.81	0.78	0.67	0.63
9	1/2" airspace	0.69	0.58	0.47	0.54	1.27	1.07	1.00	0.80	0.77	0.66	0.62
10	1/4" argon space	0.72	0.61	0.49	0.56	1.23	1.03	0.97	0.76	0.74	0.63	0.58
11	1/2" argon space	0.67	0.56	0.44	0.51	1.23	1.03	0.97	0.76	0.74	0.63	0.58
	Double Glazing, *e*=0.40 on surface 2 or 3											
12	1/4" airspace	0.74	0.63	0.51	0.58	1.25	1.05	0.99	0.78	0.76	0.64	0.60
13	1/2" airspace	0.66	0.55	0.44	0.51	1.24	1.04	0.98	0.77	0.75	0.64	0.59
14	1/4" argon space	0.69	0.57	0.46	0.53	1.18	0.99	0.92	0.72	0.70	0.58	0.54
15	1/2" argon space	0.63	0.51	0.40	0.47	1.20	1.00	0.94	0.74	0.71	0.60	0.56
	Double Glazing, *e*=0.20 on surface 2 or 3											
16	1/4" airspace	0.70	0.59	0.48	0.55	1.20	1.00	0.94	0.74	0.71	0.60	0.56
17	1/2" airspace	0.62	0.51	0.39	0.46	1.20	1.00	0.94	0.74	0.71	0.60	0.56
18	1/4" argon space	0.64	0.53	0.42	0.49	1.14	0.94	0.88	0.68	0.65	0.54	0.50
19	1/2" argon space	0.57	0.46	0.35	0.42	1.15	0.95	0.89	0.68	0.66	0.55	0.51
	Double Glazing, *e*=0.10 on surface 2 or 3											
20	1/4" airspace	0.68	0.57	0.45	0.52	1.18	0.99	0.92	0.72	0.70	0.58	0.54
21	1/2" airspace	0.59	0.48	0.37	0.44	1.18	0.99	0.92	0.72	0.70	0.58	0.54
22	1/4" argon space	0.62	0.51	0.39	0.46	1.11	0.91	0.85	0.65	0.63	0.52	0.47
23	1/2" argon space	0.55	0.44	0.33	0.39	1.13	0.93	0.87	0.67	0.65	0.53	0.49
	Double Glazing, *e*=0.05 on surface 2 or 3											
24	1/4" airspace	0.67	0.56	0.44	0.51	1.17	0.97	0.91	0.70	0.68	0.57	0.52
25	1/2" airspace	0.57	0.46	0.35	0.42	1.17	0.98	0.91	0.71	0.69	0.58	0.53
26	1/4" argon space	0.60	0.49	0.38	0.44	1.09	0.89	0.83	0.63	0.61	0.50	0.45
27	1/2" argon space	0.53	0.42	0.31	0.38	1.11	0.91	0.85	0.65	0.63	0.52	0.47
	Triple Glazing											

Product Type		Vertical Installation				Sloped Installation						
		Unlabeled Glazed Wall Systems (Site Built Windows) (includes site assembled fixed windows only, does not include operable windows)				**Unlabeled Skylight with Curb** (includes glass/plastic, flat/domed, fixed/operable)				**Unlabeled Skylight without Curb** (includes glass/plastic, flat/domed, fixed/operable)		
Frame Type		Aluminum without Thermal Break	Aluminum with Thermal Break	Wood/Vinyl	Structural Glazing	Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum Clad Wood	Wood/Vinyl	Aluminum without Thermal Break	Aluminum with Thermal Break	Structural Glazing
28	1/4" airspaces	0.63	0.52	0.41	0.47	1.12	0.89	0.84	0.64	0.64	0.53	0.48
29	1/2" airspaces	0.57	0.46	0.35	0.41	1.10	0.87	0.81	0.61	0.62	0.51	0.45
30	1/4" argon spaces	0.60	0.49	0.38	0.43	1.09	0.86	0.80	0.60	0.61	0.50	0.44
31	1/2" argon spaces	0.55	0.45	0.34	0.39	1.07	0.84	0.79	0.59	0.59	0.48	0.42
	Triple Glazing, *e*=0.20 on surface 2,3,4, or 5											
32	1/4" airspaces	0.59	0.48	0.37	0.42	1.08	0.85	0.79	0.59	0.60	0.49	0.43
33	1/2" airspaces	0.52	0.41	0.30	0.35	1.05	0.82	0.77	0.57	0.57	0.46	0.41
34	1/4" argon spaces	0.54	0.44	0.33	0.38	1.02	0.79	0.74	0.54	0.55	0.44	0.38
35	1/2" argon spaces	0.49	0.38	0.28	0.33	1.01	0.78	0.73	0.53	0.54	0.43	0.37
	Triple Glazing, *e*=0.20 on surfaces 2 or 3 and 4 or 5											
36	1/4" airspaces	0.55	0.45	0.34	0.39	1.03	0.80	0.75	0.55	0.56	0.45	0.39
37	1/2" airspaces	0.48	0.37	0.26	0.31	1.01	0.78	0.73	0.53	0.54	0.43	0.37
38	1/4" argon spaces	0.50	0.39	0.29	0.34	0.99	0.75	0.70	0.50	0.51	0.40	0.35
39	1/2" argon spaces	0.45	0.34	0.24	0.29	0.97	0.74	0.69	0.49	0.50	0.39	0.33
	Triple Glazing, *e*=0.10 on surfaces 2 or 3 and 4 or 5											
40	1/4" airspaces	0.54	0.43	0.32	0.37	1.01	0.78	0.73	0.53	0.54	0.43	0.37
41	1/2" airspaces	0.46	0.35	0.25	0.29	0.99	0.76	0.71	0.51	0.52	0.41	0.36
42	1/4" argon spaces	0.48	0.38	0.27	0.32	0.96	0.73	0.68	0.48	0.49	0.38	0.32
43	1/2" argon spaces	0.42	0.32	0.21	0.26	0.95	0.72	0.67	0.47	0.48	0.37	0.31
	Quadruple Glazing, *e*=0.10 on surfaces 2 or 3 and 4 or 5											
44	1/4" airspaces	0.49	0.38	0.28	0.33	0.97	0.74	0.69	0.49	0.50	0.39	0.33
45	1/2" airspaces	0.43	0.32	0.22	0.27	0.94	0.71	0.66	0.46	0.47	0.36	0.30
46	1/4" argon spaces	0.45	0.34	0.24	0.29	0.93	0.70	0.65	0.45	0.46	0.35	0.30
47	1/2" argon spaces	0.41	0.30	0.20	0.24	0.91	0.68	0.63	0.43	0.44	0.33	0.28
48	1/4" krypton spaces	0.41	0.30	0.20	0.24	0.88	0.65	0.60	0.40	0.42	0.31	0.25

Compliance Forms

CERTIFICATE OF COMPLIANCE (Part 1 of 2) ENV-1

PROJECT NAME		DATE
PROJECT ADDRESS		
PRINCIPAL DESIGNER-ENVELOPE	TELEPHONE	Building Permit #
DOCUMENTATION AUTHOR	TELEPHONE	Checked by/Date Enforcement Agency Use

GENERAL INFORMATION

DATE OF PLANS	BUILDING CONDITIONED FLOOR AREA	CLIMATE ZONE

BUILDING TYPE	☐ NONRESIDENTIAL	☐ HIGH RISE RESIDENTIAL	☐ HOTEL/MOTEL GUEST ROOM
PHASE OF CONSTRUCTION	☐ NEW CONSTRUCTION	☐ ADDITION ☐ ALTERATION	☐ UNCONDITIONED (file affidavit)
METHOD OF ENVELOPE COMPLIANCE	☐ COMPONENT	☐ OVERALL ENVELOPE	☐ PERFORMANCE

STATEMENT OF COMPLIANCE

This Certificate of Compliance lists the building features and performance specifications need to comply with Title 24, Parts 1 and 6 of the California Code of Regulations. This certificate applies only to building envelope requirements.

The documentation preparer hereby certifies that the documentation is accurate and complete.

DOCUMENTATION AUTHOR	SIGNATURE	DATE

The Principal Envelope Designer hereby certifies that the proposed building design represented in this set of construction documents is consistent with the other compliance forms and worksheets, with the specifications, and with any other calculations submitted with this permit application. The proposed building has been designed to meet the envelope requirements contained in sections 110, 116 through 118, and 140, 142, 143 or 149 of Title 24, Part 6.

Please check one:

☐ I hereby affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code to sign this document as the person responsible for its preparation; and that I am licensed in the State of California as a civil engineer or mechanical engineer, or I am a licensed architect.

☐ I affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code by section 5537.2 or 6737.3 to sign this document as the person responsible for its preparation; and that I am a licensed contractor performing this work.

☐ I affirm that I am eligible under Division 3 of the Business and Professions Code to sign this document because it pertains to a structure or type of work described as exempt pursuant to Business and Professions Code Sections 5537, 5538 and 6737.1.

(These sections of the Business and Professions Code are printed in full in the Nonresidential Manual.)

PRINCIPAL ENVELOPE DESIGNER-NAME	SIGNATURE	DATE	LIC. #

ENVELOPE MANDATORY MEASURES

Indicate location on plans of Note Block for Mandatory Measures _____

INSTRUCTIONS TO APPLICANT

For Detailed instructions on the use of this and all Energy Efficiency Standards compliance forms, please refer to the Nonresidential Manual published by the California Energy Commission.

ENV-1: Required on plans for all submittals. Part 2 may be incorporated in schedules on plans.

ENV-2: Used for all submittals; choose appropriate form depending on method of envelope compliance.

ENV-3: Optional. Use if default U-factors are not used. Choose appropriate form for assembly U-factor to be calculated.

CERTIFICATE OF COMPLIANCE (Part 2 of 2) ENV-1

PROJECT NAME	DATE

OPAQUE SURFACES

Surface Type	Construction Type (e.g., Block, Wood, Metal)	Area	U-factor	Azimuth	Tilt	Solar Gains Y/N	Form 3 Reference	Location/Comments (e.g., Suspended Ceiling, Demising, etc.)	NOTES TO FIELD - For Building Dept. Use Only
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			
						☐ ☐			

FENESTRATION SURFACES

Site Assembled Glazing

☐ Check box if Building is ≥100,000 ft^2 of CFA and ≥10,000 ft^2 of vertical glazing then NFRC Certification is required. Follow NFRC 100-SB Procedures and submit NFRC Label Certificate Form.

Fenestration Type	Area	U-factor	Azimuth	SHGC	Glazing Type	Location / Comments	NOTES TO FIELD – For Bldg. Dept. Use Only

EXTERIOR SHADING

Fenestration #	Exterior Shade Type	SHGC	Window		Overhang				Left Fin			Right Fin		
			Height	Widt	Length	Height	LExt.	RExt.	Dist.	Length	Height	Dist.	Length	Height

NOTES TO FIELD - For Building Department Use Only

ENVELOPE COMPONENT METHOD ENV-2

PROJECT NAME	DATE

WINDOW AREA CALCULATION and SKYLIGHT AREA CALCULATION

GROSS WALL AREA (GWA)		DISPLAY PERIMETER (DP)	
GWA x 0.40		DP x 6	

GREATER OF

If the PROPOSED WINDOW AREA is greater than the MAXIMUM ALLOWABLE WINDOW AREA, go to another method.

_____ MAX. ALLOWABLE WINDOW AREA

_____ PROPOSED WINDOW AREA

Window Wall Ratio = Proposed Window Area Divided by Gross Exterior Wall Area → _____

ATRIUM HEIGHT _____ FT

IF ≤ 55 FT IF > 55 FT

0.10 X _____ = _____ GROSS ROOF AREA ALLOWED AREA

0.05 X _____ = _____

If the ACTUAL SKYLIGHT AREA is greater than the ALLOWED SKYLIGHT AREA, go to another method.

_____ ACTUAL SKY. AREA

OPAQUE SURFACES

ASSEMBLY NAME (eg. Wall-1, Floor-1)	TYPE (eg. Roof, Wall, Floor)	HEAT CAPACITY	INSULATION R-VALUE*		ASSEMBLY U-FACTOR*			
			PROPOSED	MINIMUM ALLOWED	PROPOSED	TABLE VALUES? Y	TABLE VALUES? N	MAXIMUM ALLOWED
						☐	☐	
						☐	☐	
						☐	☐	
						☐	☐	
						☐	☐	

* For each assembly type, meet the minimum insulation R-value or the maximum assembly U-factor.

WINDOWS

WINDOW NAME (e.g., Window-1, Window-2)	ORIENTATION N	E	S	W	U-FACTOR PROP.	ALLOW.	# OF PANES	PROPOSED RSHG SHGC	H	V	H/V	OHF	PROP. RSHG	ALLOWED RSHG
	☐	☐	☐	☐										
	☐	☐	☐	☐										
	☐	☐	☐	☐										
	☐	☐	☐	☐										

SKYLIGHTS

SKYLIGHT NAME (e.g., Sky-1, Sky-2)	GLAZING With Curb	With No Curb	Plastic	# OF PANES	U-FACTOR PROPOSED	ALLOWED	SOLAR HEAT GAIN COEFFICIENT PROPOSED	ALLOWED
	☐	☐	☐					
	☐	☐	☐					
	☐	☐	☐					
	☐	☐	☐					

OVERALL ENVELOPE METHOD (Part 1 of 6) ENV-2

PROJECT NAME	DATE

WINDOW AREA TEST

A. DISPLAY PERIMETER		FT × 6 =		SF DISPLAY AREA
B. GROSS EXTERIOR WALL AREA		SF × 0.40 =		SF 40% AREA
C. GROSS EXTERIOR WALL AREA		SF × 0.10 =		SF MINIMUM STANDARD AREA
D. ENTER LARGER OF A OR B				SF MAXIMUM STANDARD AREA
E. ENTER PROPOSED WINDOW AREA				SF PROPOSED AREA

F. WINDOW WALL RATIO = Proposed Window Area Divided by Gross Exterior Wall Area = ____

IF E IS GREATER THAN D OR LESS THAN C, PROCEED TO THE NEXT CALCULATION FOR WINDOW AREA ADJUSTMENT. IF NOT, GO TO PART 2 OF 6.

1. IF E IS GREATER THAN D:

MAXIMUM STANDARD AREA		PROPOSED WINDOW AREA		WINDOW ADJUSTMENT FACTOR
	÷		=	

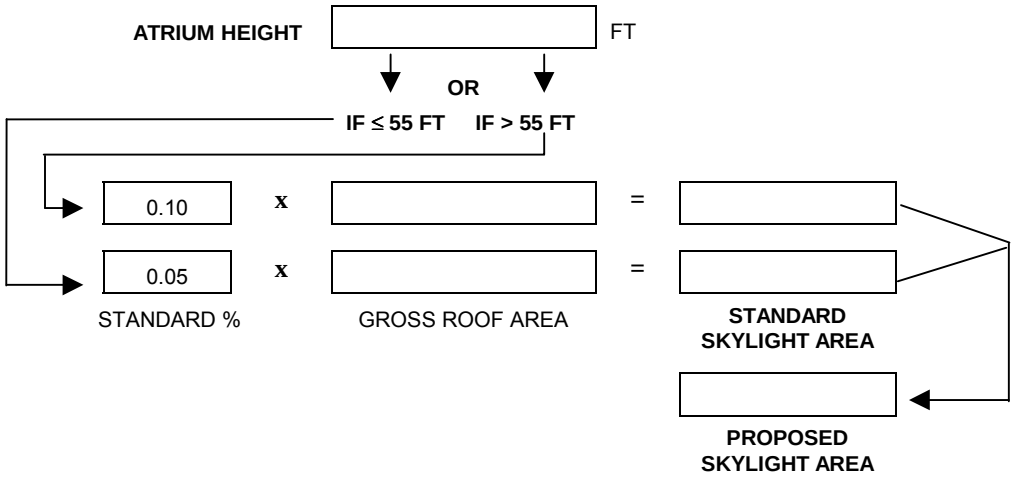
GO TO PART 6 TO CALCULATE ADJUSTED AREA

2. IF LESS THAN C:

MINIMUM STANDARD AREA		PROPOSED WINDOW AREA (IF E = 0 ENTER 1)		WINDOW ADJUSTMENT FACTOR
	÷		=	

GO TO PART 6 TO CALCULATE ADJUSTED AREA

SKYLIGHT AREA TEST



IF THE PROPOSED SKYLIGHT AREA IS GREATER THAN THE STANDARD SKYLIGHT AREA, PROCEED TO THE NEXT CALCULATION FOR THE SKYLIGHT AREA ADJUSTMENT. IF NOT, GO TO PART 2 OF 6.

1. IF PROPOSED SKYLIGHT AREA ≥ STANDARD SKYLIGHT AREA:

STANDARD SKYLIGHT AREA		PROPOSED SKYLIGHT AREA (IF E = 0 ENTER 1)		SKYLIGHT ADJUSTMENT FACTOR
	÷		=	

GO TO PART 6 TO CALCULATE ADJUSTED AREAS

OVERALL ENVELOPE METHOD (Part 2 of 6) ENV-2

PROJECT NAME | DATE

OVERALL HEAT LOSS

	A			B	C	D		E	F	G	H
				PROPOSED					STANDARD		
	ASSEMBLY NAME (e.g. Wall-1, Floor-1)			AREA	HEAT CAPACITY	U-FACTOR	TABLE VALUES? Y	TABLE VALUES? N	UA (B × D)	AREA* (Adjusted)	U-FACTOR	UA (F × G)
WALLS							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
ROOFS/CEILINGS							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
FLOORS/SOFFITS							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
							☐	☐				
WINDOWS		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
SKYLIGHTS		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				
		# OF PANES			N/A		☐	☐				

* If Window and/or Skylight Area Adjustment is Required, use adjusted areas from part 6 of 6.

TOTAL ◄ Column E shall be no greater than column H ► TOTAL

OVERALL ENVELOPE METHOD (Part 3 of 6) ENV-2

PROJECT NAME | DATE

OVERALL HEAT GAIN FROM CONDUCTION

	A			B	C	D	E		F	G	H	I	J
				PROPOSED						STANDARD			
	ASSEMBLY NAME (e.g. Wall-1, Floor-1)			AREA	TEMP. FACTOR	HEAT CAPACITY	U-FACTOR	TABLE VALUES? Y	TABLE VALUES? N	HEAT GAIN (B ×C ×E)	AREA* (Adjusted)	U-FACTOR	TEMP. FACTOR	HEAT GAIN (G ×H ×I)
WALLS								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
ROOFS/CEILINGS								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
FLOORS/SOFFITS								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
								☐	☐					
WINDOWS		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
SKYLIGHTS		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
		# OF PANES				N/A		☐	☐					
										SUBTOTAL				SUBTOTAL

* If Window and/or Skylight Area Adjustment is Required, use adjusted areas from part 6 of 6.

OVERALL ENVELOPE METHOD (Part 4 of 6) ENV-2

PROJECT NAME	DATE

OVERALL HEAT GAIN FROM RADIATION OPAQUE SURFACES

	A	B	C	D	E	F	G	H	I	J	K
					PROPOSED			STANDARD			
	ASSEMBLY NAME (e.g. Roof-1)	AREA	SOLAR FACTOR	WEIGHT FACTOR	U-FACTOR	Absorp α	HEAT GAIN ($B \times C x D \times E x F$)	AREA***** (Adjusted)	U-FACTOR	Absorp α	HEAT GAIN ($C \times D x H \times I x J$)

SUBTOTAL	**SUBTOTAL**

OVERALL ENVELOPE METHOD (Part 5 of 6) ENV-2

PROJECT NAME | DATE

OVERALL HEAT GAIN FROM RADIATION — FENESTRATION SURFACES

	A	B	PROPOSED C	D	E	F	G	H	I	STANDARD J	K	L	M
	WINDOW/SKYLIGHT NAME (e.g Window-1, Sky-1)	WEIGHTING FACTOR	AREA	SOLAR FACTOR	SHGC	OVERHANG H	OVERHANG V	OVERHANG H/V	OVERHANG OHF	HEAT GAIN (BxCx DxExH)	AREA (Adjusted)*	RSHG or SHGC**	SOLAR FACTOR	HEAT GAIN (B×J×K×L)
NORTH														
EAST														
SOUTH														
WEST														
SKYLIGHTS						N/A	N/A	N/A	N/A					
						N/A	N/A	N/A	N/A					
						N/A	N/A	N/A	N/A					
						N/A	N/A	N/A	N/A					
						N/A	N/A	N/A	N/A					
						Part 3 Subtotal					Part 3 Subtotal			
						Part 4 Subtotal					Part 4 Subtotal			
						Part 5 Subtotal					Part 5 Subtotal			
						TOTAL					TOTAL			

* If Window and/or Skylight Area Adjustment is Required, use adjusted areas from part 6 of 6.

** Only SHGC is used for Skylights

Column **I** must be less than column **M**

OVERALL ENVELOPE METHOD (Part 6 of 6) ENV-2

PROJECT NAME	DATE

WINDOW AREA ADJUSTMENT CALCULATIONS

☐ CHECK IF NOT APPLICABLE (see Part 1 of 6)

A					B	C	D	E	F	G
WALL NAME (e.g. Wall-1, Wall-2)	ORIENTATION				GROSS AREA	DOOR AREA	WINDOW AREA	WINDOW ADJUSTMENT FACTOR (From Part 1)	ADJUSTED WINDOW AREA (D×E)	ADJUSTED WALL AREA B-(F+C)
	N	E	S	W						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
	☐	☐	☐	☐						
TOTALS:										

SKYLIGHT AREA ADJUSTMENT CALCULATIONS

☐ CHECK IF NOT APPLICABLE (see Part 1 of 6)

A	B	C	D	E	F
ROOF NAME (e.g. Roof-1, Roof-2)	GROSS AREA	SKYLIGHT AREA	SKYLIGHT ADJUSTMENT FACTOR (From Part 1)	ADJUSTED SKYLIGHT AREA (C×D)	ADJUSTED ROOF AREA (B - E)
TOTALS:					

CERTIFICATE OF COMPLIANCE (Part 1 of 2) MECH-1

PROJECT NAME		DATE
PROJECT ADDRESS		
PRINCIPAL DESIGNER-ENVELOPE	TELEPHONE	Building Permit
DOCUMENTATION AUTHOR	TELEPHONE	Checked by/Date Enforcement Agency Use

GENERAL INFORMATION

DATE OF PLANS	BUILDING CONDITIONED FLOOR AREA	CLIMATE ZONE

BUILDING TYPE	☐ NONRESIDENTIAL	☐ HIGH RISE RESIDENTIAL		☐ HOTEL/MOTEL GUEST ROOM
PHASE OF CONSTRUCTION	☐ NEW CONSTRUCTION	☐ ADDITION	☐ ALTERATION	☐ UNCONDITIONED (file affidavit)
METHOD OF MECHANICAL COMPLIANCE		☐ PRESCRIPTIVE		☐ PERFORMANCE
PROOF OF ENVELOPE COMPLIANCE	☐ PREVIOUS ENVELOPE PERMIT			☐ ENVELOPE COMPLIANCE ATTACHED

STATEMENT OF COMPLIANCE

This Certificate of Compliance lists the building features and performance specifications need to comply with Title 24, Parts 1 and 6 of the California Code of Regulations. This certificate applies only to building mechanical requirements.

The documentation preparer hereby certifies that the documentation is accurate and complete.

DOCUMENTATION AUTHOR	SIGNATURE	DATE

The Principal Mechanical Designer hereby certifies that the proposed building design represented in this set of construction documents is consistent with the other compliance forms and worksheets, with the specifications, and with any other calculations submitted with this permit application. The proposed building has been designed to meet the mechanical requirements contained in the applicable parts of Sections 110 through 115, 120 through 124, 140 through 142, 144 and 145.

Please check one:

☐ I hereby affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code to sign this document as the person responsible for it's preparation; and that I am licensed in the State of California as a civil engineer or mechanical engineer, or I am a licensed architect.

☐ I affirm that I am eligible under the exemption to Division 3 of the Business and Professions Code by Section 5537.2 or 6737.3 to sign this document as the person responsible for its preparation; and that I am a licensed contractor performing this work.

☐ I affirm that I am eligible under the exemption to Division 3 of the Business and Professions Code to sign this document because it pertains to a structure or type of work described pursuant to Business and Professions Code sections 5537, 5538, and 6737.1.

(These sections of the Business and Professions Code are printed in full in the Nonresidential Manual.)

PRINCIPAL ENVELOPE DESIGNER-NAME	SIGNATURE	DATE	LIC. #

ENVELOPE MANDATORY MEASURES

Indicate location on plans of Note Block for Mandatory Measures _____

INSTRUCTIONS TO APPLICANT

For Detailed instructions on the use of this and all Energy Efficiency Standards compliance forms, please refer to the Nonresidential Manual published by the California Energy Commission.
MECH-1: Required on plans for all submittals. Part 2 may be incorporated in schedules on plans.
MECH-2: Required for all submittals, but may be incorporated in schedules on plans.
MECH-3: Required for all submittals unless required ventilation rates and airflows are shown on plans, See 4.3.4.
MECH-4: Required for all prescriptive submittals.
MECH-5: Optional. Performance use only for mechanical distribution summary.

CERTIFICATE OF COMPLIANCE (Part 2 of 2) MECH-1

PROJECT NAME	DATE

SYSTEM FEATURES

	MECHANICAL SYSTEMS			
SYSTEM NAME				**NOTE TO FIELD Bldg. Dept. Use**
TIME CONTROL				
SETBACK CONTROL				
ISOLATION ZONES				
HEAT PUMP THERMOSTAT?				
ELECTRIC HEAT?				
FAN CONTROL				
VAV MINIMUM POSITION CONTROL?				
SIMULTANEOUS HEAT/COOL?				
HEAT AND COOL SUPPLY RESET?				
HEAT REJECTION CONTROL				
VENTILATION				
OUTDOOR DAMPER CONTROL?				
ECONOMIZER TYPE				
DESIGN O.A. CFM (MECH-3, COLUMN H)				
HEATING EQUIPMENT TYPE				
HIGH EFFICIENCY? / IF YES ENTER EFF. #				
MAKE AND MODEL NUMBER				
COOLING EQUIPMENT TYPE				
HIGH EFFICIENCY? / IF YES ENTER EFF. #				
MAKE AND MODEL NUMBER				
PIPE INSULATION REQUIRED?				
PIPE/DUCT INSULATION PROTECTED?				
HEATING DUCT LOCATION / R-VALUE				
COOLING DUCT LOCATION / R-VALUE				
VERIFIED SEALED DUCTS IN CEILING/ROOF SPACE / %FAN FLOW				

CODE TABLES: Enter code from table below into columns above.

	Y:Yes	N:No
HEAT PUMP THERMOSTAT?		
ELECTRIC HEAT?		
VAV MINIMUM POSITION CONTROL?		
SIMULTANEOUS HEAT/COOL?		
HEAT AND COOL SUPPLY RESET?		
HIGH EFFICIENCY?		
PIPE INSULATION REQUIRED?		
PIPE/DUCT INSULATION PROTECTED?		
SEALED DUCTS IN CEILING/ROOF SPACE?		

TIME CONTROL	SETBACK CTRL.	ISOLATION ZONES	FAN CONTROL
S: Prog. Switch O: Occupancy Sensor M: Manual Timer	H: Heating C: Cooling B: Both	Enter number of Isolation Zones	I: Inlet Vanes P: Variable Pitch V: VFD O: Other C: Curve

VENTILATION	OUTDOOR DAMPER	ECONOMIZER	O.A. CFM
B: Air Balance C: Outside Air Cert. M: Outside Air Measure D: Demand Control N: Natural	A: Auto G: Gravity	A: Air W: Water N: Not Required EC: Economizer Control See Section 144(e)3	Enter Design Outdoor Air CFM. Note: This shall be no less than Column H on MECH-3.

MECHANICAL EQUIPMENT SUMMARY (Part 1 of 2) MECH-2

PROJECT NAME	DATE

CHILLER AND TOWER SUMMARY

					PUMPS					
Equipment Name	Equipment Type	Qty.	Effi-ciency	Tons	Total Qty	GPM	BHP	Motor Eff.	Drive Eff.	Pump Control

DHW / BOILER SUMMARY

								TANK INSUL.
System Name	System Type	Distribution Type	Qty.	Rated Input	Vol. (Gals.)	Energy Factor or Recovery Efficiency	Standby Loss or Pilot	Ext. R-Val

CENTRAL SYSTEM RATINGS

			HEATING			COOLING			
System Name	System Type	Qty.	Output	Aux. kW	Effi-ciency	Output	Sensible	Effi-ciency	Economizer Type

CENTRAL FAN SUMMARY

			SUPPLY FAN				RETURN FAN			
System Name	Fan Type	Motor Location	CFM	BHP	Motor Eff.	Drive Eff.	CFM	BHP	Motor Eff.	Drive Eff.

MECHANICAL EQUIPMENT SUMMARY (Part 2 of 2) MECH-2

PROJECT NAME	DATE

VAV SUMMARY

	VAV					FAN					BASEBOARD	
Zone Name	System Type	Qty.	Min. CFM Ratio	Reheat? Type	Reheat? ΔT	Flow Ratio	CFM	BHP	Motor Eff.	Drive Eff.	Type	Output

EXHAUST FAN SUMMARY

EXHAUST FAN						EXHAUST FAN					
Room Name	Qty.	CFM	BHP	Motor Eff.	Drive Eff.	Room Name	Qty.	CFM	BHP	Motor Eff.	Drive Eff.

MECHANICAL VENTILATION MECH-3

PROJECT NAME	DATE

MECHANICAL VENTILATION

A	B	C	D	E	F	G	H	I	J	K
	AREA BASIS			**OCCUPANCY BASIS**			**REQ'D.**	**DESIGN**		
ZONE/ SYSTEM	COND AREA (SF)	CFM PER SF	MIN. CFM (B X C)	NO. OF PEOPLE	CFM PER PERSON	MIN. CFM (E X F)	**O.A.** (MAX. OF D OR G)	**OUTDOOR AIR CFM**	**VAV MIN. CFM**	**TRANSFER AIR CFM**
	Totals (For MECH-4)									

C	Minimum ventilation rate per Section § 121, Table 1-F.
E	Based on expected number of occupants or at least 50% of Chapter 10 1997 UBC occupant density
I	Must be greater than or equal to H, or use Transfer Air. Design outdoor air includes ventilation from supply air system & exhaust fans which Operate at design conditions.
K	Must be greater than or equal to (H - I), and, for VAV, greater than or equal to (H - J).

MECHANICAL SIZING AND FAN POWER MECH-4

PROJECT NAME	DATE
SYSTEM NAME	FLOOR AREA

NOTE: Provide one copy of this form for each mechanical system when using the Prescriptive Approach.

SIZING and EQUIPMENT SELECTION

1. DESIGN CONDITIONS:

		COOLING	HEATING
- OUTDOOR, DRY BULB TEMPERATURE	(APPENDIX C)		
- OUTDOOR, WET BULB TEMPERATURE	(APPENDIX C)		
- INDOOR, DRY BULB TEMPERATURE	(1993 ASHRAE handbook, See Chap. 8, Fig. 5)		

2. SIZING

- DESIGN OUTDOOR AIR				
- ENVELOPE LOAD				
- LIGHTING				
- PEOPLE				
- MISCELLANEOUS EQUIPMENT				
- OTHER		(Describe)		
- OTHER		(Describe)		
- OTHER		(Describe)		
		TOTALS		
OTHER LOADS/SAFETY FACTOR (enter 1.21 for cooling and 1.43 heating)				
MAXIMUM ADJUSTED LOAD (TOTALS FROM ABOVE X OTHER LOAD/SAFETY FACTOR)				

3. SELECTION:

	COOLING	HEATING
INSTALLED EQUIPMENT CAPACITY		
	KBtu / Hr	**KBtu / Hr**

IF INSTALLED CAPACITY EXCEEDS MAXIMUM

ADJUSTED LOAD, EXPLAIN _____

FAN POWER CONSUMPTION

A	B	C	D	E	F	G
FAN DESCRIPTION	**DESIGN BRAKE HP**	**EFFICIENCY** MOTOR	**EFFICIENCY** DRIVE	**NUMBER OF FANS**	**PEAK WATTS** B x E x 746 / (C x D)	**CFM** (Supply Fans)
			TOTALS			

NOTE: Include only fan systems exceeding 25 HP (see § 144). Total Fan System Power Demand may not exceed 0.8 Watts/CFM for constant volume systems or 1.25 Watts/CFM for VAV systems.

TOTAL FAN SYSTEM POWER DEMAND WATTS / CFM _____ Col. F / Col. G

MECHANICAL DISTRIBUTION SUMMARY PERFORMANCE USE ONLY MECH-5

PROJECT NAME	DATE
SITE ADDRESS	PERMIT NUMBER

VERIFIED DUCT TIGHTNESS BY INSTALLER

☐ **DUCT LEAKAGE REDUCTION** **Pressurization Test Results (Aerosol or Manual Sealing) CFM @ 25 PA**

	Measured Values
Test Leakage (CFM)	

Fan Flow

If Fan Flow is Calculated as 400 cfm/ton x number of tons, or as 21.7 x Heating Capacity in Thousands of Btu/hr, enter calculated value here	
If Fan Flow is Measured, enter measured value here	
Leakage Fraction = Test Leakage / (Calculated or Measured Fan Flow)	
Check Box for Pass or Fail (Pass = 6% or less of Leakage Fraction)	☐ Pass ☐ Fail

Tests Performed	Signature Date	Installing Subcontractor (Co. Name) **OR** General Contractor (Co. Name)

HERS RATER COMPLIANCE STATEMENT

☐ **BUILDING TESTED** **Pressurization Test Results (Aerosol or Manual Sealing) CFM @ 25 PA**

As the HERS rater providing diagnostic testing and field verification, I certify that the building identified on this form complies with the diagnostic tested compliance requirements as checked on this form.

Supply Duct R-value _____ (R-value 4.2 or greater)
Return Duct R-value _____ (R-value 4.2 or greater)

☐ Distribution system is fully ducted (i.e., does not use building cavities as plenums or platform returns in lieu of ducts)

☐ Where cloth backed, rubber adhesive duct tape is installed, mastic and drawbands are used in combination with cloth backed, rubber adhesive duct tape to seal leaks at duct connections.

☐ Minimum Requirements for Duct Leakage Reduction Compliance Credit

	Measured Values
Test Leakage (CFM)	

Fan Flow

If Fan Flow is Calculated as 400 cfm/ton x number of tons, or as 21.7 x Heating Capacity in Thousands of Btu/hr, enter calculated value here	
If Fan Flow is Measured, enter measured value here	
Leakage Fraction = Test Leakage / (Calculated or Measured Fan Flow)	
Check Box for Pass or Fail (Pass = 6% or less of Leakage Fraction)	☐ Pass ☐ Fail

Tests Performed	Signature Date	HERS Rater (Name)

COPY TO: Building Department, HERS Provider (if applicable), and Building Owner at Occupancy

CERTIFICATE OF COMPLIANCE (Part 1 of 3) LTG-1

PROJECT NAME		DATE
PROJECT ADDRESS		
PRINCIPAL DESIGNER-LIGHTING	TELEPHONE	Building Permit
DOCUMENTATION AUTHOR	TELEPHONE	Checked by/Date Enforcement Agency Use

GENERAL INFORMATION

DATE OF PLANS	BUILDING CONDITIONED FLOOR AREA	CLIMATE ZONE

BUILDING TYPE ☐ NONRESIDENTIAL ☐ HIGH RISE RESIDENTIAL ☐ HOTEL/MOTEL GUEST ROOM

PHASE OF CONSTRUCTION ☐ NEW CONSTRUCTION ☐ ADDITION ☐ ALTERATION ☐ UNCONDITIONED (file affidavit)

METHOD OF LIGHTING COMPLIANCE ☐ COMPLETE BLDG. ☐ AREA CATEGORY ☐ TAILORED ☐ PERFORMANCE

STATEMENT OF COMPLIANCE

This Certificate of Compliance lists the building features and performance specifications need to comply with Title 24, Parts 1 and 6 of the California Code of Regulations. This certificate applies only to building lighting requirements.

The documentation preparer hereby certifies that the documentation is accurate and complete.

DOCUMENTATION AUTHOR	SIGNATURE	DATE

The Principal Lighting Designer hereby certifies that the proposed building design represented in this set of construction documents is consistent with the other compliance forms and worksheets, with the specifications, and with any other calculations submitted with this permit application. The proposed building has been designed to meet the lighting requirements contained in the applicable parts of Sections 110, 119,130 through 132, 146, and 149 of Title 24, Part 6.

Please check one:

☐ I hereby affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code to sign this document as the person responsible for its preparation; and that I am licensed in the State of California as a civil engineer or electrical engineer, or I am a licensed architect.

☐ I affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code by section 5537.2 or 6737.3 to sign this document as the person responsible for its preparation; and that I am a licensed contractor performing this work.

☐ I affirm that I am eligible under Division 3 of the Business and Professions Code to sign this document because it pertains to a structure or type of work described as exempt pursuant to Business and Professions Code Sections 5537,5538 and 6737.1.

(These sections of the Business and Professions Code are printed in full in the Nonresidential Manual.)

PRINCIPAL ENVELOPE DESIGNER-NAME	SIGNATURE	DATE	LIC. #

LIGHTING MANDATORY MEASURES

Indicate location on plans of Note Block for Mandatory Measure _____

INSTRUCTIONS TO APPLICANT

For detailed instructions on the use of this and all Energy Efficiency Standards compliance forms, please refer to the Nonresidential Manual published by the California Energy Commission.
LTG-1: Required on plans for all submittals. Part 2 and 3 may be incorporated in schedules on plans.
LTG-2: Required for all submittals.
LTG-3: Optional. Uses only if lighting control credits are taken.
LTG-4: Optional. Part 2 and 3 and LTG-5 are optional if Tailored Method if used.

CERTIFICATE OF COMPLIANCE (Part 2 of 3) LTG-1

PROJECT NAME	DATE

INSTALLED LIGHTING SCHEDULE

		LAMPS			BALLAST		Luminaire		TOTAL WATTS
Name	LUMINAIRE DESCRIPTION	Type DESCRIPTION	No. of Lamps	Watts Per Lamp	Type DESCRIPTION	No. of Ballast	No. of Lumin.	Watts/ Lumin.	

Lighting Schedule on Plans Shows Exterior Lighting Meets

- ☐ Efficacy and Control Requirement of § 130(c)
- ☐ Control Requirements of § 131(f)

SUBTOTAL FROM THIS PAGE	
PLUS SUBTOTAL FROM CONTINUATION PAGE	
PORTABLE LIGHTING (From LTG-1 Part 3 of 3)	
LESS CONTROL CREDIT WATTS (From LTG-3)	
ADJUSTED ACTUAL WATTS	

MANDATORY AUTOMATIC CONTROLS

CONTROL LOCATION (Room #)	CONTROL IDENTIFICATION	CONTROL TYPE (Auto Time Switch, Exterior, etc.)	SPACE CONTROLLED	NOTE TO FIELD

CONTROLS FOR CREDIT

CONTROL LOCATION (Room # or Dwg. #)	CONTROL IDENTIFICATION	CONTROL TYPE (Occupant, Daylight, Dimming, etc.)	LUMINAIRES CONTROLLED		NOTE TO FIELD
			TYPE	# OF LUMINAIRES	

NOTES TO FIELD - For Building Department Use Only

PORTABLE LIGHTING WORKSHEET (Part 3 of 3) LTG-1

PROJECT NAME	DATE

TABLE 1A – PORTABLE LIGHTING NOT SHOWN ON PLANS FOR OFFICE AREA > 250 SQUARE FEET

A	B	C	D
ROOM # OR ZONE ID	DEFAULT	AREA (SF)	TOTAL WATTS (B X C)
	0.2		
	0.2		
	0.2		
	0.2		
	0.2		
	0.2		
	TOTAL		

TABLE 1B – PORTABLE LIGHTING SHOWN ON PLANS FOR OFFICE AREA > 250 SQUARE FEET

A	B	C	D	E	F	G
ROOM # OR ZONE ID	PORTABLE LIGHTING DESCRIPTION(S) PER TASK AREA	LUMINAIRE(S) WATTS PER TASK AREA	TASK AREA (SF)	NUMBER OF TASK AREAS	TOTAL AREA (SF) (D X E)	TOTAL WATTS (C X E)
				TOTAL		

TABLE 1C – PLANS SHOW PORTABLE LIGHTING IS NOT REQUIRED FOR OFFICE AREAS > 250 SQUARE FEET

ROOM # OR ZONE ID	TOTAL AREA (SF)
TOTAL	

Designer needs to provide detailed documentation that the lighting level provided by the overhead lighting meets the needs of the space. The details include luminaire types, CU, and mounting locations relative to work areas.

BUILDING SUMMARY – PORTABLE LIGHTING

BUILDING SUMMARY	TOTAL AREA (SF) (FROM TABLES 1A+1B+1C)	TOTAL WATTS (FROM TABLES 1A+1B)
BUILDING TOTAL		

Enter on LTG-1 and 2: Portable Lighting

LIGHTING COMPLIANCE SUMMARY LTG-2

PROJECT NAME	DATE

ACTUAL LIGHTING POWER

LUMINAIRE NAME	Type DESCRIPTION	NUMBER OF LUMINAIRES	WATTS PER LUMINAIRE (Including Ballast)	CEC DEFAULT? Y	CEC DEFAULT? N	TOTAL WATTS
				☐	☐	
				☐	☐	
				☐	☐	
				☐	☐	
				☐	☐	
				☐	☐	
				☐	☐	
				☐	☐	
				☐	☐	
				☐	☐	

SUBTOTAL FROM THIS PAGE	
PLUS SUBTOTAL FROM CONTINUATION PAGE	
PORTABLE LIGHTING (From LTG-1 Part 3 of 3)	
LESS CONTROL CREDIT WATTS (From LTG-3)	
ADJUSTED ACTUAL WATTS	

ALLOWED LIGHTING POWER (Choose One Method)

COMPLETE BUILDING METHOD

BUILDING CATEGORY (From § 146(b) Table 1-M)	WATTS PER SF	COMPLETE BLDG. AREA	ALLOWED WATTS

AREA CATEGORY METHOD

AREA CATEGORY (From § 146(b) Table 1-N)	WATTS PER SF	WATTS (SF)	ALLOWED WATTS
TOTALS		AREA	WATTS

TAILORED METHOD

TOTAL ALLOWED WATTS (From LTG-4)	

LIGHTING CONTROLS CREDIT WORKSHEET LTG-3

PROJECT NAME	DATE

WORKSHEET

A	B	C	D	E	F	G	H	I
			ROOM	DAYLIGHTING		WATTS OF	LIGHTING	CONTROL
ROOM # ZONE ID	LIGHTING CONTROL DESCRIPTION	PLANS REF.	AREA (SF)	ROOM RATIO*	GLAZING VLT	CONTROL LIGHTING	ADJUSTMENT FACTOR	CREDIT WATTS (G X H)

*For windows, use the Window Wall Ratio for the room. For skylights, use the Skylight-to Roof ratio for the room.

PAGE TOTAL →

BUILDING TOTAL →

Enter on LTG-1 and 2: Plus Subtotal From Continuation Page

TAILORED LPD SUMMARY and WORKSHEET (Part 1 of 3) LTG-4

PROJECT NAME | DATE

TAILORED METHOD

1. Watts for Illuminance Categories A-D (from column G below) → ______ WATTS

2.Watts for Illuminance Categories E-I (from LTG-4 Part 2) → ______ WATTS

3. Watts for Display Lighting (from LTG-4 Parts 2 & 3)

Public Area Display	+	Sales Feature Floor Display	+	Sales Feature Wall Display	=	WATTS
	+		+		=	

4. Total Allowed Watts (lines 1+2+3) → ______ WATTS

TAILORED LPD - Illuminance Categories A, B, C and D and Gross Sales Floor Area

A ROOM NUMBER	B TASK/ACTIVITY	C ILLUMINANCE CATEGORY	D ROOM CAVITY RATIO	E FLOOR AREA	F ALLOWED LPD	G ALLOWED WATTS (E X F)

		Floor Area	Allowed Watts
PAGE TOTAL	→		
BUILDING TOTAL	→	SF	WATTS

TAILORED LPD SUMMARY and WORKSHEET (Part 2 of 3) LTG-4

PROJECT NAME	DATE

TAILORED LPD - Illuminance Categories E, F, G, H, I and Gross Sales Wall Area

A	B	C	D	E	F	G	H	I	J	K	L
				ALLOTTED WATTS			DESIGN WATTS				
TASK / ACTIVITY	Illum. Cat.	RCR (If E)	Notes*	TASK AREA (sf)	ALLOWED LPD	ALLOTTED WATTS (E X F)	LUMIN. CODE	. QTY	WATTS/ LUMIN.	DESIGN WATTS (I X J)	**ALLOWED WATTS** (Min. G or K)

PAGE TOTAL →

BUILDING TOTAL →

* Enter Mounting Height or Throw Distance if applicable.

TAILORED LPD - Public Area Displays

A	B	C	D	E	F	G	H	I	J	K
			ALLOTTED WATTS			DESIGN WATTS				
TASK / ACTIVITY	Throw Dist.	Mtg. Hgt.	TASK AREA (sf)	ALLOWED LPD	ALLOTTED WATTS (D X E)	LUMIN. CODE	QTY.	WATTS/ LUMIN.	DESIGN WATTS (H X I)	**ALLOWED WATTS** (Min. F or J)

TOTAL AREA PUBLIC DISPLAYS ____ SF

TOTAL ____ WATTS

PLANE OF PUBLIC DISPLAY AREA ____ X 0.1 = ____ MAXIMUM AREA PUBLIC DISPLAYS (SF)

TAILORED LPD SUMMARY and WORKSHEET (Part 3 of 3) LTG-4

PROJECT NAME	DATE

TAILORED LPD - Sales Feature Floor Displays

A	B	C	D	E	F	G	H	I	J	K
			ALLOTTED WATTS			DESIGN WATTS				
TASK / ACTIVITY	THROW DISTANCE	MOUNT. HEIGHT	TASK AREA (sf)	CAT. G LPD	ALLOTTED WATTS (D X E)	LUMIN. CODE	QTY.	WATTS/ LUMIN.	DESIGN WATTS (H X I)	**ALLOWED WATTS** (Min. F or J)

TOTAL AREA FLOOR DISPLAYS ____ SF TOTAL WATTS ____

GROSS SALES FLOOR AREA ____ X 0.1 = ____ MAXIMUM AREA FLOOR DISPLAYS (SF)

TAILORED LPD - Sales Feature Wall Displays

A	B	C	D	E	F	G	H	I	J
		ALLOTTED WATTS			DESIGN WATTS				
TASK ACTIVITY	THROW DISTANCE	TASK AREA (sf)	Cat. G ALLOWED LPD	ALLOTTED WATTS (C X D)	LUMIN. CODE	QTY.	WATTS\ LUMIN.	DESIGN WATTS (G XH)	**ALLOWED WATTS** (Min. E or I)

TOTAL AREA WALL DISPLAYS ____ SF TOTAL WATTS ____

GROSS SALES WALL AREA ____ X 0.1 = ____ MAXIMUM AREA WALL DISPLAYS (SF)

ROOM CAVITY RATIO WORKSHEET (RCR ≥ 3.5) LTG-5

PROJECT NAME		FOR ENFORCEMENT AGENCY USE ONLY	
DOCUMENTATION AUTHOR	DATE	PLAN CHECKED BY	DATE

RECTANGULAR SPACES

A	B	C	D	E	F
Room Number	Task/Activity Description	Room Length (L)	Room Width (W)	Room Cavity Height (H)	Room Cav. Ratio 5 x H x (L+W) / (L x W)

NON-RECTANGULAR SPACES

A	B	C	D	E	F
Room Number	Task/Activity Description	Room Area (A)	Room Perimeter (P)	Room Cavity Height (H)	Room Cav. Ratio 2.5 x H x P /A